

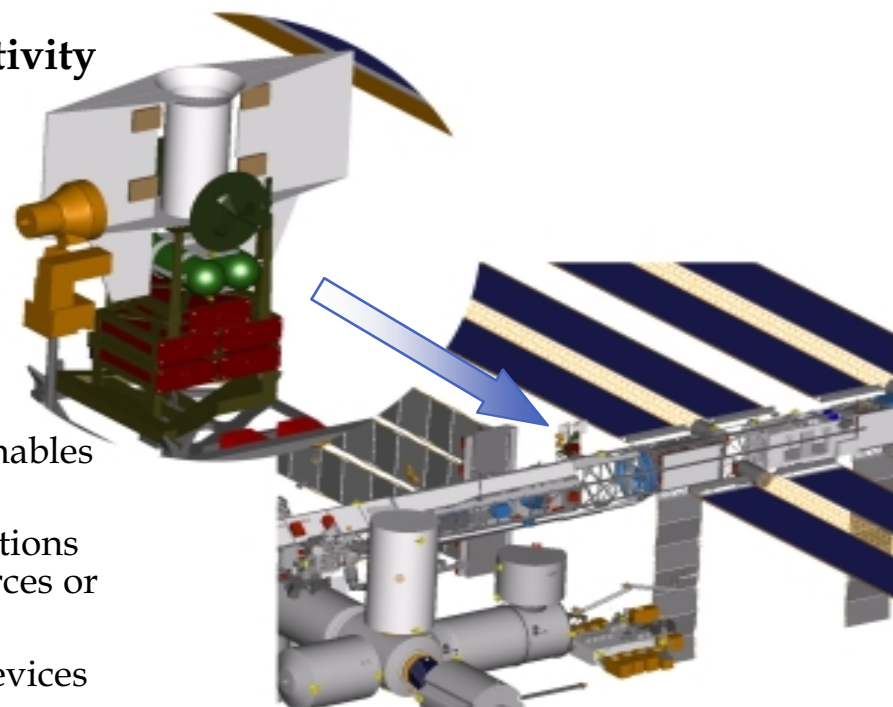


THREADS

Potential Value to ISS

Technology applications can:

- **Improve performance and crew productivity**
 - Automation of systems, payloads, health monitoring, intelligent agent technologies
 - Advanced crew interfaces enhance crew effectiveness
- **Reduce resupply and logistics**
 - Plasma engines can perform reboost with existing waste H_2
 - Closed loop life support minimizes consumables use
 - MEMS/wireless technologies provide functions with reduced drain or impact on ISS resources or infrastructure
 - Miniature sensors, processors, and other devices have minimal impact on sparing



Research at ISS can benefit ISS as well as future programs:

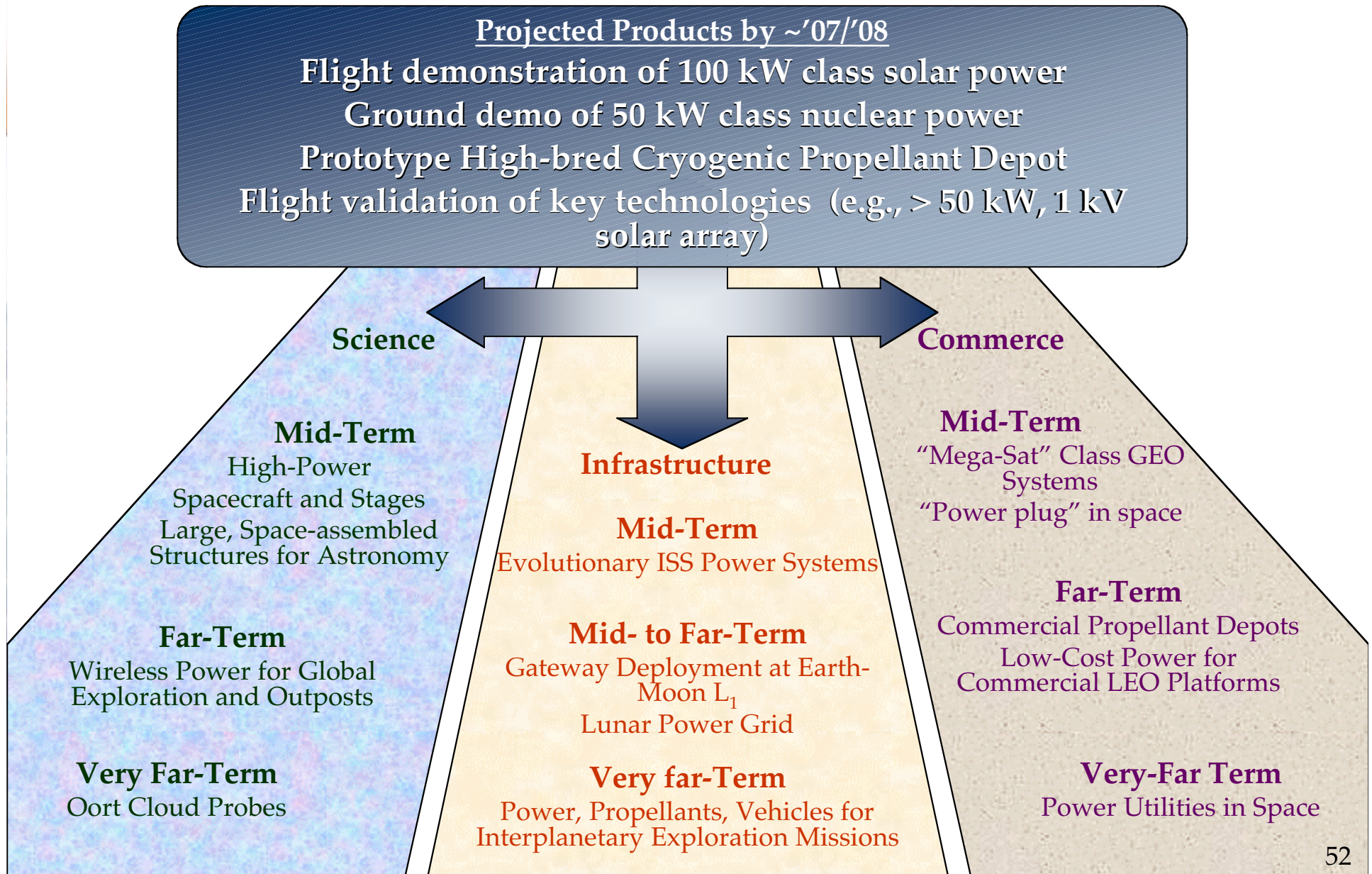
- **Improve knowledge base on space environmental effects on humans contributes to better health and safety for crews,**
 - Zero G and radiation
 - Human performance over long mission durations
- **Systems exposure to operational and space environment**
 - Contributes to long term reliability
 - Contributes to evolution of simpler designs and better control of functions





THREADS

Projected Products and Benefits -- Examples





THREADS Commercial Development of Space

Space Resources Development

- ✓ Lunar Resources
- ✓ Asteroid Resources

Space Utilities & Power

- ✓ Space Solar Power
- ✓ Cryogenic Propellant Depots

Habitation & Bioastronautics

- ✓ Habitable Volume
- ✓ Extravehicular Activity

Space Assembly, Inspection & Servicing

- ✓ Platform Assembly
- ✓ In-Space Servicing

Exploration & Expeditions

- ✓ Virtual Exploration
- ✓ Surface Systems

Space Transportation

- ✓ ETO
- ✓ Affordable In-Space
- ✓ Excursion Transport

On Earth (US Industry)

Information and Communications
Agriculture
Energy and Natural Resources
Health Care and Medicine
Transportation and Automotive

In Earth Orbit

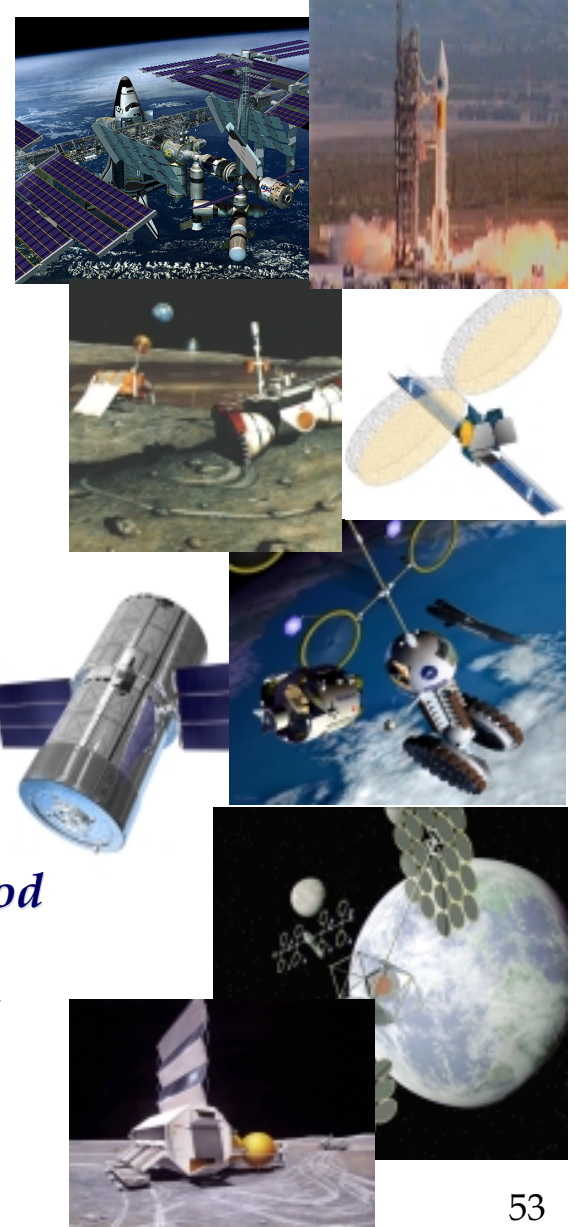
Commercial Ventures on ISS
Space Business Parks in LEO
Mega-CommSats in GEO
Public Space Travel

Earth's Neighborhood

Lunar Virtual Exploration
Space Transportation Services
Space Power Utilities
Spacecraft and Platform Servicing
Lunar Resources Development

Beyond Earth's Neighborhood

Mars Virtual Exploration
Government Mission support (e.g.,
Mars Campaign Launch,
Communications, etc.)





THREADS Assessment of THREADS Applicability

- **Assessment of potential applications of the technologies included in THREADS to a wide range of potential areas, including**
 - Space Science
 - Commercial Space Development
 - Human Space Flight
- **An approach for pursuing this action has been developed, including:**
 - A consistent forecast of mission/market developments in these three areas during the 10-25+ Years (reaching out to the very far term in some cases)
 - Identification of potential architectures and systems concepts that represent good candidate approaches to achieving the projected missions / markets
 - Creation of a simple scoring methodology to identify the possible applicability and/or benefits of THREADS to the forecast
 - Development of a spread sheet tool embodying the forecast and scoring
- **An initial analysis has been completed**
 - Three timeframes: Near-to-mid, Mid-to-far, Far and beyond
 - For each timeframe: No applicability = 0; Applicable, but not critical = 0.5; Critical = 1.0

Percentage of Overlap

Human Space Flight	100%
Space Science	69%
Commercial	95%





THREADS Assessing FY'03 Resources

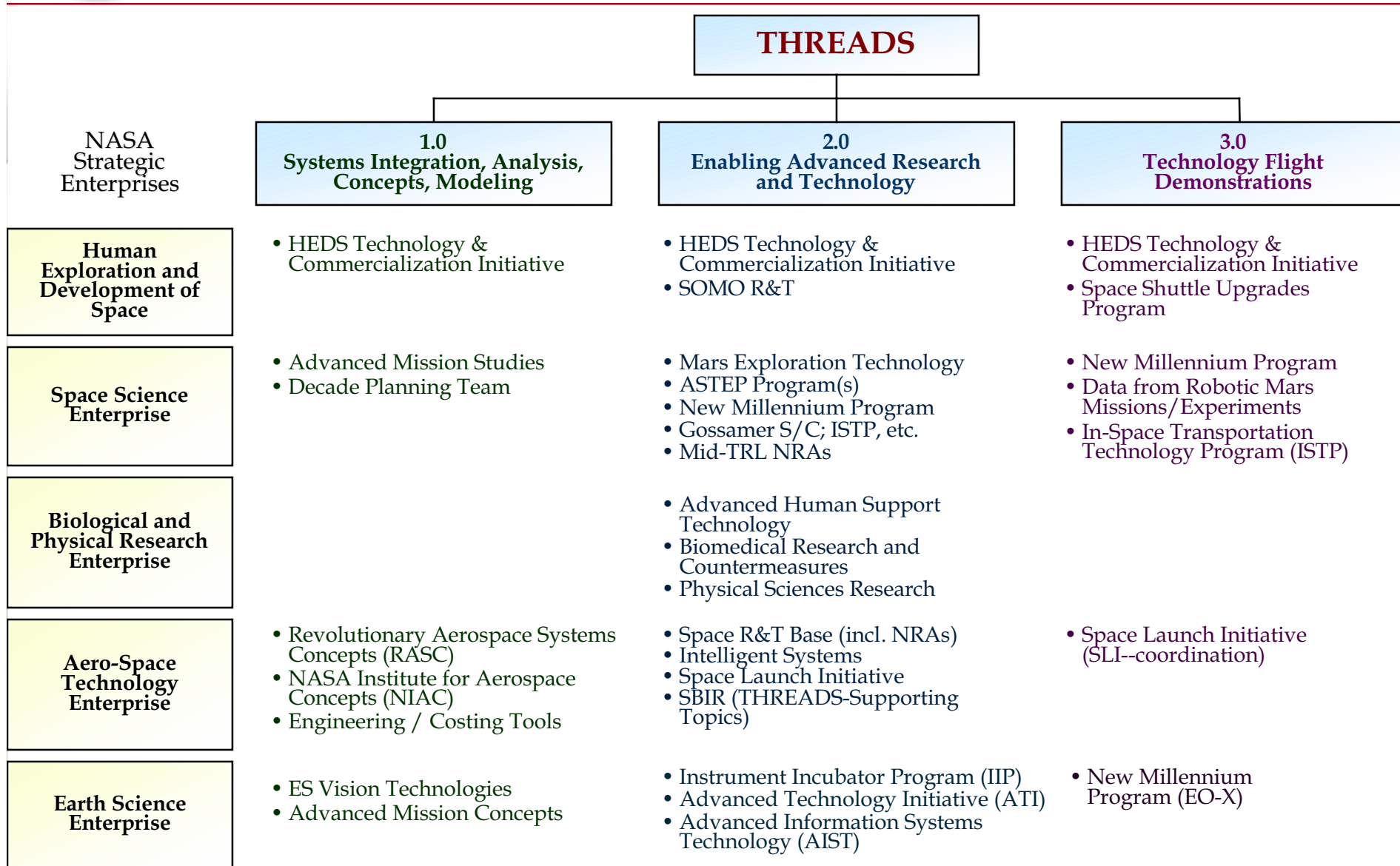
Assumptions/Ground rules

- **Opportunity for decisions anticipated to be mid-to-late in this decade**
- **General strategy: make investments to support future decisions**
 - Emphasis on investments that enable leveraging of existing NASA (or other Agency, etc.) programs
 - Emphasis on investments that support dual-purpose applications (e.g., nearer term NASA space science, commercial space, etc.)
 - Down-select to higher-priority R&D investments
- **Defer substantial investments in full-scale human-rated space demonstrations (e.g., habitation systems) of systems-technologies, pending future decisions**
- **The Space Launch Initiative (SLI) R&T results are anticipated, but resources for SLI are not included in gap analysis details**





THREADS An Agency-Wide Approach

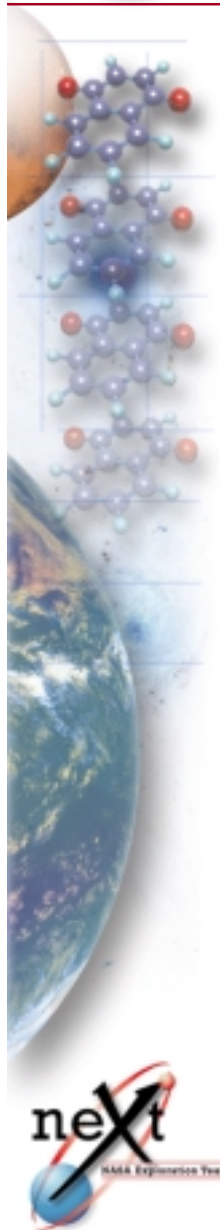


AND ... Opportunities from investments in studies and technology from outside NASA, including other US Agencies, US Industry and International Organizations



Overview FY01 Focus Areas

- **Prioritize investments to achieve Agency goals**
- **Improve understanding of the Earth's Neighborhood**
 - Refine concepts and science needs
- **Improve definition of the robotic/human partnership in space**
 - Capture the state-of-the-art for future robotics
 - Quantify and compare robotic/human performance in projected operations
 - Increase understanding of critical Bioastronautics issues
- **Advance Technology for Human/Robotic Exploration and Development of Space (THREADS)**
 - Discover innovative concepts and technology
 - Show progress in key technology areas
- **Expand leveraging activities**
 - Active investments from; NIAC, RASC, SBIR, SSP
 - DoD - opportunities through Technology Area Review and Assessment (TARA), Advanced Concept Technology Demonstrations (ACTD), etc.
 - Education; Steckler Trust





Leveraging Revolutionary Concepts

Searching for Transformational Ideas for NEXT Across The Agency

Revolutionary
Technologies

Advanced System
Concepts

New Missions
and Markets

NEXT

Regenerative
Aerobraking

Revolutionary
Rockets

M2P2



Invariant
Manifolds

L₁ Gateway



Stretched
Lens Array

**Enterprise
Advanced Concepts**

Power Beaming
Infrastructures



Space
Solar
Power



Hybrid
Propellant
Module



**Agency
Advanced
Concepts
RASC
and NIAC**

Comet-Asteroid
Protection System



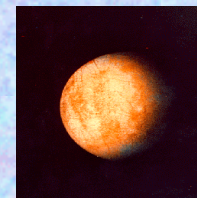
Transformers

X-ray
Interferometer

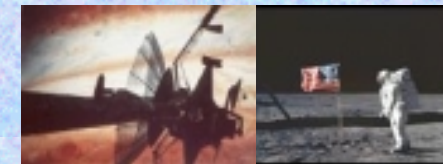


In-Space Remote
Sensing

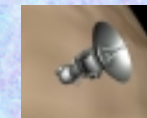
Humans to
the Moons
of the Outer
Planets



Human & Robotic Exploration

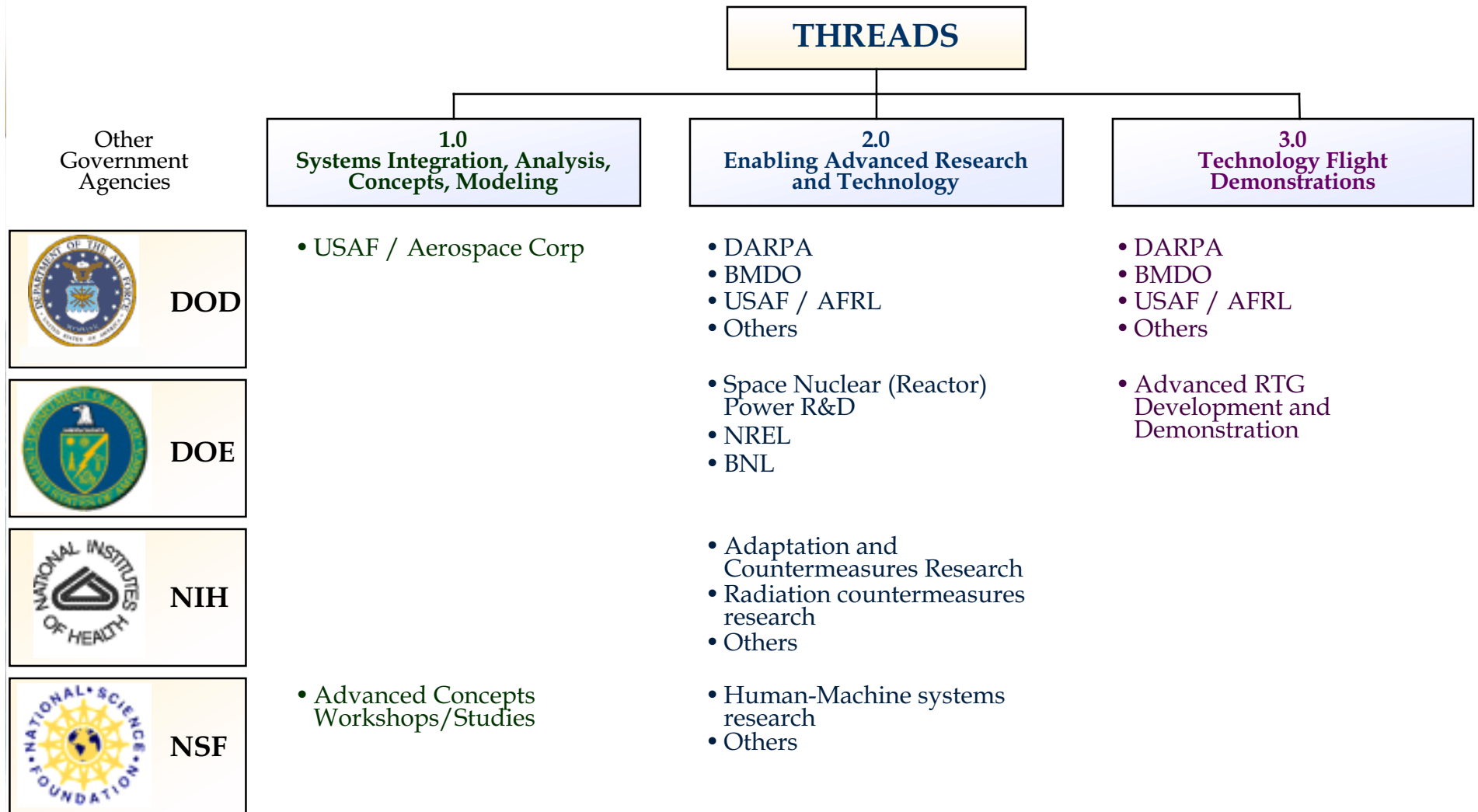


Exobiological Existence
of Life in Europa





Leveraging Government-Wide Opportunities



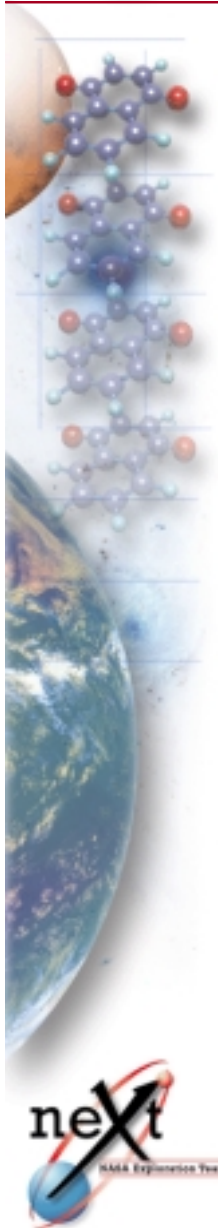
AND ... Opportunities from investments in studies and technology with other US Agencies, US Industry and International Organizations



Leveraging Coordination With Other Agencies

Initiatives under Review:

- Engage with DoD Director of Research & Engineering for NASA participation in DoD Technology Area Review & Assessment (TARA) process
- Get NEXT oriented membership on Defense Science Board
- Coordinate to meet NEXT technological objectives with :
 - OSD - Special Asst. for civil space
 - NRO - S&T Coord.
 - U.S. SPACOM - Ops Coord.
 - AFRL - Sr. Scientist/Technologist
 - SMC - Requirements Coord.
 - BMDO/NMD - S&T Coord.
- Map and coordinate NEXT and DoD technology plans and investments
- Develop NEXT-DoD Technology Initiatives Exercise
- Align JPL's Project Development Center with TARA for periodic NEXT S&T maturity assessment
- Engage with BMDO Chief Scientist on technology pursuit and investment and on SBIR coordinated management
- Develop mission rationales and functional interfaces for DoD and NEXT technologists
- Partner with DoD organizations developing NEXT ACTDs and ATDs for submission to DoD
- Build broad agency involvement in NEXT related developments, operations and applications (USGS, NOAA, EPA, NRO, SBA, et. al.)



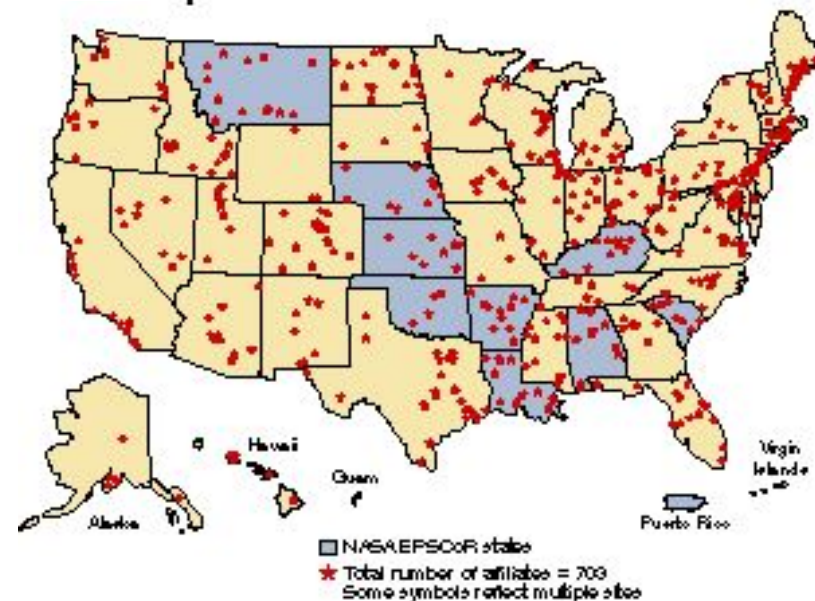


Leveraging Educational Opportunity

- **Ralph Steckler/Space Grant
Space Colonization Research
and Technology Opportunity**

- Mr. Steckler selected NASA as the beneficiary of his estate so that students can creatively address the challenges of space colonization.
- Matching DPT funds plus Codes M and U contributions provide ~\$1M/year for the next three years
- Program announcement released March 22, 2001
- Received 29 proposals addressing topics as diverse as artificial gravity, terraforming, and extraterrestrial crop production
- Awards to be made in FY02 for one to three year research grants

Space Grant Affiliates





NEXT Goals for FY02

Continue the process of integrating the Agency's exploration activities and technology investments to realize the NEXT Exploration Strategy

- Pursue robotic/human partnership
- Proceed with Technology for Human/Robotic Exploration and Development of Space (THREADS)
- Expand leveraging activities with other government, private, and international coalitions



**“As for the future, your task is not to
foresee it, but to enable it”**

Antoine de Saint-Exupery

